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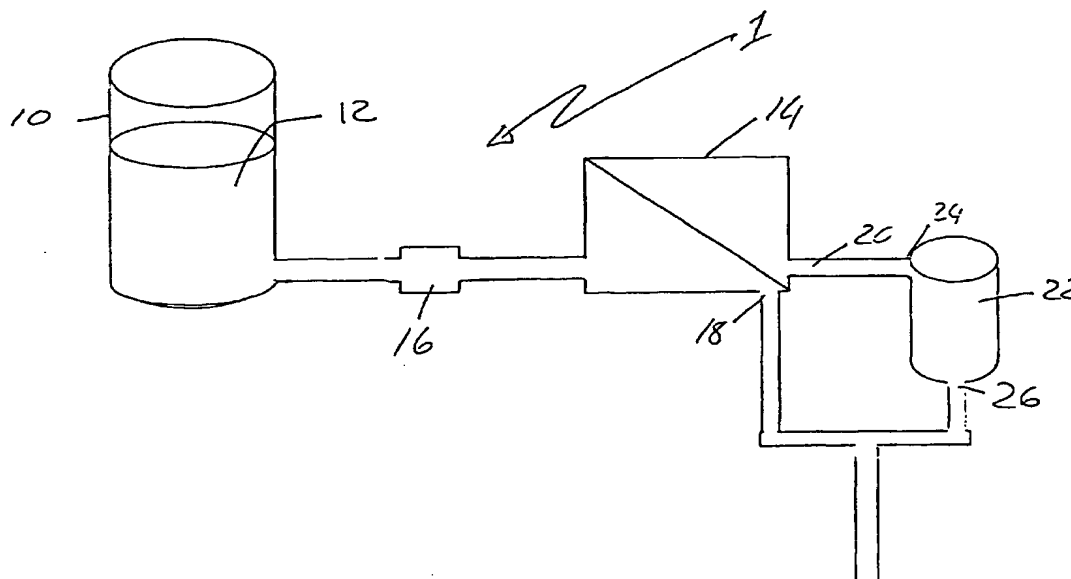
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- with international search report
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: APPARATUS AND METHOD FOR ISOLATING AND/OR ELIMINATING SOLUTES FROM A SOLUTION



(57) Abstract: This invention relates to an apparatus for removing solutes from a solution using a nano-filtration means to provide a treated solution.

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**APPARATUS AND METHOD FOR ISOLATING AND/OR ELIMINATING  
SOLUTES FROM A SOLUTION**

**15    FIELD OF THE INVENTION**

This invention relates to the isolation and/or elimination of solutes from a solution, more particularly from beverages.

**BACKGROUND TO THE INVENTION**

20    It is well-known in the art that during the course of the production of certain beverages, compounds are produced which detract from the flavour and quality of the beverage. This is a particular problem associated with the production of alcoholic beverages where compounds such as ethyl acetate, acetic acid, and acetaldehyde are detrimental to the flavour and aroma of the alcoholic beverage.

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It is also known in the art that such undesirable compounds may be removed from solution by means of reverse osmosis. This process of reverse osmosis requires elevated pressures to achieve its effect, resulting in an increase in temperature. It is commonly known that certain volatile components in solution are adversely affected by an increase in  
30    temperature that leads to associated unfavourable development of derivatives of integral solutes in solution, or even more unfavourably the generation of contaminating

compounds in solution. Reverse osmosis also only removes up to 15% of the volatile acidity from the wine in a single pass. If higher levels are to be removed using the reverse osmosis process, the wine has to then be passed 2-3 times which can lead to a further deterioration in the whole quality of the wine as well as excessive increases in temperature. To limit, insofar as possible, the effects of the reverse osmosis on the quality of the treated solution heat exchangers are utilised, which is costly and cumbersome.

Ultra-filtration is also known to remove unwanted compounds from a solution. However, this requires low pressure with concomitant detrimental effects to the solution insofar as desirable compounds also pass through into the permeate.

### **OBJECT OF THE INVENTION**

It is an object of the invention to provide an apparatus, which, at least partially, alleviates the above-mentioned problems.

It is a further object of the invention to provide a method, which, at least partially, alleviates some of the above-mentioned problems.

### **SUMMARY OF THE INVENTION**

In accordance with the invention there is provided an apparatus for removing at least one solute from a solution comprising a receptacle for a solution; a nano-filtration means in fluid communication with the receptacle; a means for driving the solution through the nano-filtration means to produce a retentate at a retentate outlet and a raw permeate at a raw permeate outlet; a separation means having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration means and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated solution.

In accordance with this embodiment of the invention the separation means is preferably a treatment column, the column being an ion exchange column, alternatively a hydrophobic interaction column, further alternatively an affinity column, still further alternatively a gel filtration or gel exclusion column.

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In accordance with a further embodiment of the invention there is an apparatus for removing at least one solute from an untreated alcoholic beverage comprising a receptacle for the untreated alcoholic beverage; a nano-filtration means in fluid communication with the receptacle; a means for driving the untreated alcoholic beverage through the nano-filtration unit to produce a retentate at a retentate outlet and a raw permeate at a raw permeate outlet; an anion exchange column having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration unit and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated untreated alcoholic beverage.

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Furthermore, in accordance with the invention there is provided a method for treatment of a solution to remove at least one solute from a solution, including the steps of subjecting the solution to a process of nano-filtration for producing a retentate and a raw permeate, with the raw permeate containing the solute; treating the raw permeate for removing at least a portion of the solute to provide a treated permeate; and combining the retentate and the treated permeate to provide a treated solution, preferably the treatment of the raw permeate occurs under high pH conditions on an anion exchange column.

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#### **BRIEF DESCRIPTION OF THE DRAWINGS**

One embodiment of the invention is described below, by way of example only, with reference to the accompanying drawing where:

Figure 1 is a schematic view of apparatus for isolating and/or eliminating a solute from a solution.

5 **DETAILED DESCRIPTION WITH REFERENCE TO THE DRAWINGS**

With reference to the drawing an apparatus (1) for removing a compound (not shown) of interest from an untreated alcoholic beverage (12) is illustrated. The apparatus (1) has a receptacle (10) which receives the untreated alcoholic beverage (12), a nano-filtration unit (14) which is in fluid communication with the receptacle (10) and a pump (16) to drive the  
10 untreated alcoholic beverage (12) through the nano-filtration unit (14) to produce a retentate (not shown) at a retentate outlet (18) and a raw permeate (not shown) at a raw permeate outlet (20) and a anion exchange column (22) having an inlet (24) which is in fluid communication with the raw permeate outlet (20) of the nano-filtration unit (14) and a treated permeate effluent outlet (26) which is in fluid communication with the retentate  
15 outlet (18) which, when the apparatus (1) is in use, combines the retentate (not shown) egressing from the retentate outlet (18) with the treated permeate (not shown) egressing from the treated permeate effluent outlet (26) to provide a treated alcoholic beverage (not shown).

20 One embodiment of the method for treatment of an untreated alcoholic beverage (12) to remove at least one compound (not shown) from the untreated alcoholic beverage (12) includes the steps of subjecting the untreated alcoholic beverage (12) to a process of nano-filtration through the nano-filtration unit (14) to produce a retentate (not shown) and a raw permeate (not shown), with the raw permeate (not shown) containing the compound  
25 to be removed from the raw permeate (not shown) followed by treating the raw permeate (not shown) by passage through an anion exchange column under high pH conditions (22) thereby removing at least a portion of the compound (not shown) to provide a treated permeate (not shown); and combining the retentate (not shown) and the treated permeate (not shown) to provide a treated alcoholic beverage.

It will be appreciated that numerous variations, which will be apparent to those skilled in the art, can be made to the above-mentioned embodiment of the invention without departing from the scope thereof. In particular the means for driving the untreated  
5 solution through the nano-filtration unit may be gravity-based.

**Claims**

1. An apparatus for removing at least one solute from a solution comprising a receptacle for a solution; a nano-filtration means in fluid communication with the receptacle; a means for driving the solution through the nano-filtration means to produce a retentate at a retentate outlet and a raw permeate at a raw permeate outlet; a separation means having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration means and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated solution.
2. An apparatus as claimed in claim 1, wherein the separation means is a treatment column.
3. An apparatus as claimed in claim 2 wherein the column is an ion exchange column.
4. An apparatus as claimed in claim 2 wherein the column is a hydrophobic interaction column.
5. An apparatus as claimed in claim 2 wherein the column is an affinity column.
6. An apparatus as claimed in claim 2 wherein the column is a gel filtration- column or gel exclusion column.
7. An apparatus as claimed in claim 1 for removing at least one solute from an untreated alcoholic beverage comprising a receptacle for the untreated alcoholic beverage; a nano-filtration means in fluid communication with the receptacle; a means for driving the untreated alcoholic beverage through the nano-filtration unit to produce a retentate at a retentate outlet and a raw permeate at a raw permeate

outlet; an anion exchange column having an inlet which is in fluid communication with the raw permeate outlet of the nano-filtration unit and a treated permeate effluent outlet which is in fluid communication with the retentate outlet which, in use, combines the retentate egressing from the retentate outlet with the treated permeate egressing from the treated permeate effluent outlet to provide a treated untreated alcoholic beverage.

8. A method for treatment of a solution to remove at least one solute from a solution, including the steps of subjecting the solution to a process of nano-filtration for producing a retentate and a raw permeate, with the raw permeate containing the solute; treating the raw permeate for removing at least a portion of the solute to provide a treated permeate; and combining the retentate and the treated permeate to provide a treated solution, preferably the treatment of the raw permeate occurs under high pH conditions on an anion exchange column.
9. An apparatus as claimed in any one of claims 1 to 7, including any new and inventive integer or combination thereof herein described.
10. An apparatus as claimed in any one of claims 1 to 7, including any new and inventive integer or combination thereof herein exemplified.
11. A method as claimed in claim 8, including any new and inventive integer herein described.



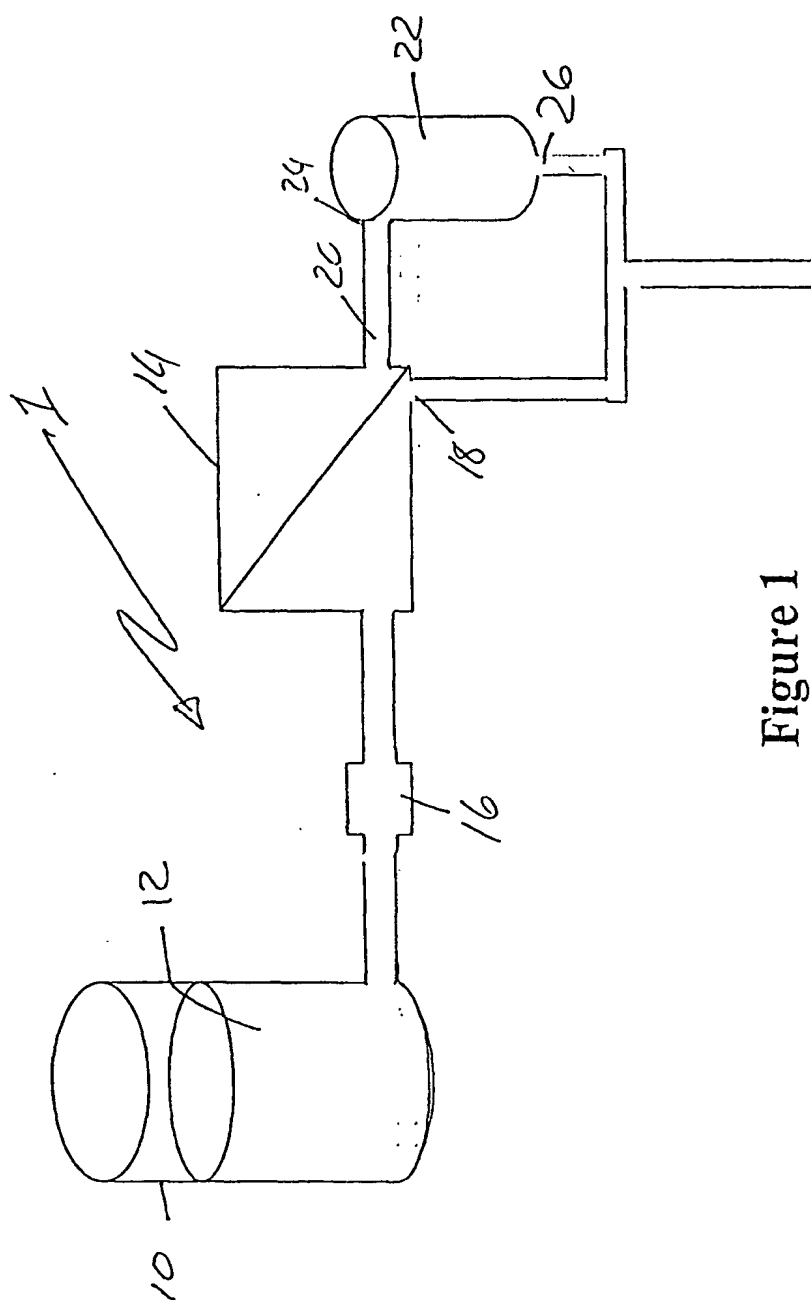


Figure 1

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/IB 01/00383

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B01D61/02 B01D61/58 C12G3/08 C12H1/04 B01D15/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B01D C12G C12H A23L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 93 23151 A (C.SMITH) 25 November 1993 (1993-11-25) abstract; claims	1-3, 7-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents:

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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